CHAPTER 8

NUTRITION

MULTIPLE CHOICE QUESTIONS

1. **Which micronutrient is required by plants for nitrogen metabolism?**
   (a) Chlorine (b) Iron (c) Zinc (d) Nickel
2. **Which one is a micronutrient?**
   (a) Potassium (b) Sulphur (c) Copper (d) Calcium
3. **Which one is a macronutrient?**
   (a) Calcium (b) Manganese (c) Molybdenum (d) Boron
4. **Which one is an organic fertilizer?**
   (a) Rock phosphate (b) Elemental sulphur (c) Compost (d) Gypsum
5. **The increase in the chemical nutrients in an ecosystem:**
   (a) Digestion (b) Assimilation (c) Eutrophication (d) Nutrition
6. **How much energy is provided by one gram of carbohydrates?**
   (a) 1000 calories (b) 2000 calories (c) 3000 calories (d) 4000 calories
7. **How much energy is provided by one gram of lipids?**
   (a) 8000 calories (b) 7000 calories (c) 9000 calories (d) 6000 calories
8. **How much energy is provided by one gram of proteins?**
   (a) 4000 calories (b) 2000 calories (c) 7000 calories (d) 5000 calories
9. **How much saturated fatty acids are present in butter?**
   (a) 40% (b) 50% (c) 60% (d) 70%
10. **How much unsaturated fatty acids are present in sunflower oil?**
    (a) 55% (b) 65% (c) 75% (d) 85%
11. **The lipids are composed of:**
    (a) Fatty acids (b) Glycerol (c) Both a & b (d) None of these
12. **Which one is a major mineral?**
    (a) Iron (b) Zinc (c) Copper (d) Calcium
13. **Which one is trace mineral?**
    (a) Sodium (b) Potassium (c) Chromium (d) Magnesium
14. **Which one trace mineral stabilizes bone mineral and hardens tooth enamel?**
    (a) Iodine (b) Fluoride (c) Zinc (d) Potassium
15. **Which one trace mineral is required for normal thyroid function?**
    (a) Iron (b) Zinc (c) Copper (d) Iodine
16. **Which minerals are required for fluid balance in the body?**
    (a) Sodium (b) Potassium (c) Chloride (d) All of these
17. **Which vitamin converts opsin into rhodopsin?**
    (a) A (b) C (c) D (d) E
18. **The first fat soluble vitamin A was identified in:**
    (a) 1910 (b) 1911 (c) 1912 (d) 1913
19. **The deficiency of which mineral causes anaemia?**
    (a) Calcium (b) Iron (c) Sodium (d) Magnesium

ADP: A nucleotide produced when ATP loses one of its phosphates to power up vital cellular processes
Aerobic respiration: A form of cellular respiration which occurs in the presence of oxygen
Alcoholic fermentation: A form of anaerobic respiration which occurs in bacteria, yeast etc and ethanol is produced along with CO2
AMP: A nucleotide produced when ADP is hydrolyzed. It is made up of adenine, ribose, and a phosphate group
Anabolism: A form of metabolism in which smaller and simpler compounds are used to generate larger and more complex compounds
Anaerobic respiration: A form of cellular respiration which occurs in the absence or shortage of oxygen
ATP: An energy-rich organic compound that is composed of adenosine (an adenine ring and a ribose sugar) and three phosphate groups.
Autotrophic: Organisms capable of synthesizing their own food by using raw materials
Bioenergetics: The study of energy relationships and energy transformations in living organisms.
Calvin cycle: A series of biochemical reactions, also called as Dark reactions, occurring in the stroma of chloroplasts to yield sugars and starch
Chlorophyll: A green pigment, found in plants, responsible for the absorption of light for photosynthesis
Coenzyme-A: A co-enzyme notable for its role in citric acid (Krebs) cycle
Electron transport chain: A group of compounds in which electrons are passed from one to another to create a proton gradient to drive ATP synthesis
FAD: Flavin adenine dinucleotide, functions as a coenzyme
Glycolysis: Degradative cellular process in which glucose is broken down to yield ATP as energy source.
Krebs cycle: A step in aerobic respiration in which Acetyl-coA is completely oxidized and broken down into carbon dioxide and water, to produce high-energy compounds.
Lactic acid fermentation: A type of anaerobic respiration which occurs in milk bacteria and skeletal muscles in the absence of oxygen
Light dependent reactions: Also called as Z-scheme, the first phase in photosynthesis occurring in the presence of light, used to make high energy compounds
Limiting factors: Agents which can affect the activity or rate of a process
Mesophyll: Photosynthetic tissue in leaves formed of parenchyma cells containing chlorophyll
Metabolism: A set of biochemical events occurring in living organisms
NAD: Nicotinamide adenine dinucleotide, a conenzyme acting as electron carrier in redox reactions
Oxidation: The addition of H^+, or the removal of electron
Photolysis: Chemical decomposition caused by light
Photosynthesis: The synthesis of glucose from carbon dioxide and water in the presence of sunlight and chlorophyll, with oxygen as a by-product
Photosystem: A cluster of photosynthetic pigments found in the thylakoids of chloroplasts
Pigments: A substance which can absorb light wavelengths of various colors
Pyruvic acid: A 3-C compound formed when glucose is broken down in cellular respiration
Reduction: Gain of electrons or the loss of H^+
Respiration: The cellular energy-yielding process in which food is oxidized to produce carbondioxide and water
Stroma: The matrix of the chloroplast which is a thick fluid in between grana where various enzymes, molecules and ions are found, and where the dark reaction of photosynthesis occurs.
Thylakoid: Membranous infoldings of chloroplast, where photosynthetic pigments are found.
Z-scheme: Also called as Light-dependent reactions, the first phase in photosynthesis occurring in the presence of light, used to make high energy compounds

SHORT QUESTIONS

Q. No. 1 Why does an organism need food?

NEED OF FOOD

Every organism needs food for:

- Growth
- Energy
- Function normally

Q. No. 2 Define nutrition.

NUTRITION

The process in which food is obtained or prepared, absorbed and converted into body substances for growth and energy, is called nutrition.

Q. No. 3 What are nutrients?

NUTRIENTS

The elements and compounds that an organism obtains and uses for energy, or for the synthesis of new materials, are called nutrients.

Q. No. 4 What is the difference between autotrophic and heterotrophic organisms?

DIFFERENCE B/W AUTOTROPHIC AND HETEROTROPHIC ORGANISMS

Autotrophic Organisms

The organisms which obtain water, carbon dioxide, and minerals from their environment and prepare their food which is then used for growth and energy are called autotrophic organisms.

Examples:

- Plants
- Some protists
- Some bacteria

Heterotrophic Organisms

The organisms which obtain their food from other organisms and use it for growth and energy are called heterotrophic organisms.

Q. No. 5 What is the difference between macronutrients and micronutrients?

DIFFERENCE B/W MACRONUTRIENTS AND MICRONUTRIENTS

Micronutrients:

The nutrients which are required by plants in large quantities are called macronutrients.

Examples:

- Carbon
- Hydrogen
- Oxygen
- Nitrogen
- Magnesium
- Potassium

Micronutrients:

The nutrients which are required by plants in small quantities are called micronutrients.

20. **The deficiency of which vitamin causes blindness?**
(a) E (b) D (c) B (d) A
21. **The deficiency of vitamin C results in:**
(a) Poor growth (b) Scurvy (c) Osteomalacia (d) Rickets
22. **Which one is an insoluble dietary fibre?**
(a) Cereals (b) Oats (c) Beans (d) Barley
23. **The estimated water requirement of an average adult per day:**
(a) 1 litre (b) 2 litres (c) 3 litres (d) 4 litres
24. **Which one is a soluble dietary fibre?**
(a) Wheat bran (b) Cereals (c) Skins of fruit (d) Oats
25. **The percentage of carbohydrates in bread:**
(a) 23% (b) 52% (c) 21% (d) 43%
26. **The percentage of carbohydrates in potato:**
(a) 19% (b) 12% (c) 31% (d) 3%
27. **The percentage of lipids in chicken:**
(a) 10% (b) 11% (c) 12% (d) 13%
28. **The percentage of proteins in eggs:**
(a) 13% (b) 15% (c) 17% (d) 19%
29. **The process of taking in of food:**
(a) Ingestion (b) Digestion (c) Absorption (d) Defecation
30. **The elimination of undigested food from the body:**
(a) Absorption (b) Assimilation (c) Defecation (d) Digestion
31. **The wave of contraction and relaxation in the smooth muscles of alimentary canal:**
(a) Lubrication (b) Mastication (c) Food selection (d) Peristalsis
32. **The length of oesophagus in adult human:**
(a) 25 cm (b) 30 cm (c) 30 cm (d) 35 cm
33. **The length of duodenum in adult human:**
(a) 10 cm (b) 15 cm (c) 25 cm (d) 40 cm
34. **The length of jejunum in adult human:**
(a) 2.1 meter (b) 2.2 meter (c) 2.3 meter (d) 2.4 meter
35. **The length of ileum in adult human:**
(a) 3.1 meter (b) 3.3 meter (c) 3.5 meter (d) 3.7 meter

ANSWERS:

1	d	2	c	3	a	4	c	5	c
6	d	7	c	8	a	9	d	10	c
11	c	12	c	13	c	14	b	15	d
16	d	17	a	18	d	19	b	20	d
21	b	22	a	23	b	24	d	25	b
26	a	27	b	28	a	29	a	30	c
31	d	32	a	33	c	34	d	35	c

Examples:

- Iron
- Molybdenum
- Boron
- Chlorine
- Zinc

Q. No. 6 What will happen if proper nutrients are not available to plants?

NON-AVAILABILITY OF PROPER NUTRIENTS

If proper nutrients are not available to plants, they show abnormalities and do not grow normally.

Q. No. 7 Why carnivorous plants have evolved mechanisms for trapping animals?

Carnivorous plants have evolved mechanisms for trapping and digesting small animals. The products of this digestion are used to supplement plant's supply of nitrogen.

Q. No. 8 If we supply organic and inorganic fertilizers to a plant, which one would be the first available to the plant for uptake?

If we supply organic and inorganic fertilizers to a plant, inorganic fertilizer would be the first available to the plant for uptake.

Q. No. 9 Which nutrients are common source of energy?

Carbohydrates are the most common source of energy. Proteins and lipids are vital building components for body but they can also be used for energy.

Q. No. 10 What are the hazards of using saturated fatty acids?

HAZARDS OF SATURATED FATTY ACIDS

They can increase a person's cholesterol level. This may eventually result in the clogging of arteries and ultimately heart disease.

Q. No. 11 Which of the major components of food is needed as the main structural component of body?

The major components of food needed as the main structural component of body are proteins.

Q. No. 12 How can hypertension and kidney stones be prevented?

PREVENTION FROM HYPERTENSION AND KIDNEY STONES

The hypertension and kidney stones can be prevented by intake of:

- Good calcium nutrition
- Low salt
- High potassium

Q. No. 13 Which vitamins are destroyed by cooking and heating?

Cooking or heating destroys water-soluble vitamins more readily than the fat-soluble vitamins.

Q. No. 14 Why the nutrient requirements of animals are complex as compared to plants?

NUTRIENT REQUIREMENTS

The nutrient requirements of humans and other animals are relatively complex as compared to plants. Like other animals, the nutrients required by humans include:

Q. No. 31 How gastric juice is secreted?

SECRETION OF GASTRIC JUICE

Some quantity of gastric juice is always present in stomach. When a bite is in oral cavity, the brain sends messages to stomach walls to secrete some gastric juice. When food reaches stomach, more gastric juice is secreted according to needs. If there is little or no protein in food, stomach does not secrete more juice. On the other hand if more proteins are present in food, abundant gastric juice is secreted. In this case, the already present gastric juice begins digestion of huge proteins into peptides.

Q. No. 32 What is gastrin:

GASTRIN

The peptides formed from the breakdown of proteins in stomach stimulate some cells of stomach walls to release a hormone called gastrin. This hormone enters blood and is distributed to all parts of body. In stomach it has a specific effect and stimulates the gastric glands to secrete more gastric juice.

Q. No. 33 If by any chance, the direction of peristalsis reverses, what would be the result?

If the direction of peristalsis reverses, the result is vomiting.

Q. No. 34 What is malnutrition?

MALNUTRITION

Problems related to nutrition are grouped as malnutrition.

Under-nutrition:

Malnutrition most commonly refers to under-nutrition, resulting from:

- Inadequate consumption
- Poor absorption
- Excessive loss

Over-Nutrition

Malnutrition also includes over-nutrition, resulting from overeating or excessive intake of specific nutrients.

Q. No. 35 What are the common causes of malnutrition?

COMMON CAUSES OF MALNUTRITION

Most commonly, malnourished people either:

- Do not have enough calories in their diet
- Eat a diet that lacks protein, vitamins or trace minerals

Q. No. 36 What are the effects of malnutrition?

EFFECTS OF MALNUTRITION

The effects of malnutrition are as follow:

- Weakens the immune-system
- Impairs physical and mental health
- Slows thinking
- Stunts growth
- Affects fetal development

Q. No. 22 What is the saying of Hippocrates about nutrition?

"Let thy food be thy medicine". -Hippocrates

Q. No. 23 Write in correct sequence the parts of alimentary canal where digestion of proteins, lipids and carbohydrates begins.

- Stomach
- Small intestine
- Oral cavity

Q. No. 24 What is appendix?

APPENDIX

A non-functional finger-like process called appendix arises from the blind end of caecum.

Appendicitis:

Appendicitis is the inflammation of the appendix which causes severe pain and may burst in severe cases and the infection may spread in the abdomen.

Treatment:

The infected appendix must be removed surgically.

Q. No. 25 How vitamin K is produced?

Many bacteria live in colon. They produce vitamin K, which is necessary for the coagulation of blood.

Q. No. 26 What are the functions of large intestine?

FUNCTIONS OF LARGE INTESTINE

The functions of large intestine include:

- The elimination of faeces
- Absorption of water & salts

Q. No. 27 In which part of the alimentary canal, maximum absorption of nutrients occurs?

The maximum absorption of nutrients occur in small intestine.

Q. No. 28 What are bile pigments?

BILE PIGMENTS

Bile contains pigments that are by-products of red blood cell destruction in liver. These bile pigments are eliminated from body with faeces.

Q. No. 29 Pepsin is a powerful protein-digesting enzyme. Why does it not digest stomach walls which are mostly proteins?

DIGESTION OF STOMACH WALLS BY PEPSIN

Pepsin is not released in its active form. It is secreted as inactive pepsinogen, which requires HCl for activation. The mucous of gastric juice forms a thick coating over the inner walls of stomach and neutralizes the HCl there. It makes pepsinogen difficult to be activated, and to attack stomach walls.

Q. No. 30 How proteins are synthesized in our body?

SYNTHESIS OF PROTEINS

We eat mutton or any food containing protein contents and digest its proteins into amino-acids, which are used to synthesize our proteins.

LONG QUESTIONS

Q. No. 1 Describe mineral nutrition in plants.

MINERAL NUTRITION IN PLANTS

Mode of Nutrition:

Plants have the most efficient mechanisms for autotrophic mode of nutrition.

Requirement of Nutrients:

Plants get carbon, hydrogen, and oxygen from carbon dioxide and water. In addition to these elements, plants also require mineral elements for various activities and structures.

Types of Nutrients:

There are two types of nutrients required by plants:

i. Macronutrients
ii. Micronutrients

i. **Macronutrients:** The nutrients which are required by plants in large quantities are called macronutrients.
For example: Carbon, hydrogen, oxygen, nitrogen, magnesium, potassium, etc.

ii. **Micronutrients:** The nutrients which are required by plants in small quantities are called micronutrients.
For example: Iron, molybdenum, boron, chlorine, zinc, etc.

ROLE OF IMPORTANT NUTRIENTS IN PLANT LIFE

Macronutrients	Role in Plant Life
Phosphorus	Component of ATP, Nucleic acids, Co-enzymes, Necessary for seed germination, photosynthesis, Protein formation,
Potassium	Regulates the opening & closing of stomata, Reduces water loss from leaves
Sulphur	Component of Proteins, Vitamins, Enzymes
Calcium	Activates enzymes Structural component of cell wall Influences water movement in cells

Micronutrients	Role in Plant Life
Iron	Necessary for photosynthesis Activates many enzymes
Molybdenum	Component of the enzyme that reduces nitrates to ammonia Important in building amino acids
Boron	Important in sugar transport, cell division and Synthesizing certain enzymes
Copper	Component of several enzymes
Manganese	Involved in enzyme activity for photosynthesis, Respiration and nitrogen metabolism
Zinc	Required in a large number of enzymes.
Chlorine	Involved in osmosis of water
Nickel	Required in nitrogen metabolism.

Q. No. 37 What is the death rate due to starvation according to the Food and Agriculture Organization of United Nations?

According to the Food and Agriculture Organization of United Nations, more than 25,000 people die of starvation everyday. On average, every five seconds, a child dies of starvation.

Q. No. 38 What will be the principle global causes of mortality?

The World Health Organization (WHO) estimates that within the next few years, diseases due to malnutrition will become the principal global causes of mortality.

Q. No. 39 What are the diffusible substances?

DIFFUSIBLE SUBSTANCES

The substances that can cross cell membranes to enter cells are called diffusible substances.

Examples:

- Water
- Salts
- Amino acids
- Simple sugars
- Fatty acids
- Vitamins

Q. No. 40 What are the non-diffusible substances?

NON-DIFFUSIBLE SUBSTANCES

The substances that can not cross cell membranes to enter cells are called non-diffusible substances. Such substances are usually parts of larger molecules which cannot cross the membranes.

Examples:

- Proteins
- Polysaccharides
- Lipids

Q. No. 41 Define digestion.

DIGESTION

The process by which large, complex, insoluble and non-diffusible molecules of food are converted into smaller, simple soluble and diffusible molecules that can cross membranes by the action of enzymes is called digestion.

Q. No. 42 Write a brief summary of the phases of digestion.

PHASES OF DIGESTION

Digestion comprises following phases:

1. **Ingestion:**
   The process of taking in food.
2. **Digestion:**
   The process of breaking up complex substances into simpler substances.
3. **Absorption:**
   Diffusion of digested food into blood and lymph.
4. **Assimilation:**
   Conversion or incorporation of absorbed simple food into the complex substances constituting the body.
5. **Defecation:**
   Elimination of undigested food from the body.

1. INORGANIC FERTILIZERS

Properties:

- Most inorganic fertilizers dissolve readily in water.
- They are immediately available to plants for uptake.

Naturally occurring Inorganic Fertilizers:

They are not chemically modified.

These include:

- Rock Phosphate
- Elemental Sulfur
- Gypsum

Nitrogen Fertilizers:

If nitrogen is the main element, they are called nitrogen fertilizers.

2. ORGANIC FERTILIZERS

Source:

The organic fertilizers are derived from plant and animal materials.

Properties:

They are more complex and take time to be broken down into forms reusable by plants.

Beneficial Aspect:

They increase soil drainage, aeration and the ability of the soil to hold nutrients.

Examples:

These include:

- Manure
- Compost

Unclear Distinction between Inorganic and Organic Fertilizers:

The distinction between organic and inorganic fertilizers is not always clear-cut. Urea, for example, is an organic compound, but chemically synthesized urea is generally grouped with inorganic fertilizers.

ENVIRONMENTAL HAZARDS RELATED TO FERTILIZERS USE

Effect on Soil:

Massive quantities of inorganic fertilizers affect the soil nutrient-holding capacity.

Eutrophication:

Their high solubilities degrade ecosystems through eutrophication, which is the increase in chemical nutrients in an ecosystem.

Emission of Green House Gases:

Storage and application of some nitrogen fertilizers may cause emission of the green house gas, nitrous oxide. Ammonia gas may be emitted from inorganic fertilizers.

Reproduction Rate of Pests:

Excessive nitrogen fertilizers lead to pest problems by increasing their reproduction rate.

Environmental Problems:

Excessive amounts of organic fertilizers cause environmental problems due to nitrate leaching, or run off of soluble organic compounds.

RECOMMENDATION FOR USE

It is recommended that the nutrient content of the soil and nutrient requirements of the crop should be calculated before the application of inorganic fertilizers.

Non-availability of Nutrients:

If any of these nutrients is not available to plant, they show abnormalities and do not grow normally.

Q. No. 2 Discuss role of nitrogen and magnesium in plants.

ROLE OF NITROGEN

Plants get nitrogen in the form of nitrates. Nitrogen metabolism is a major factor in stem and leaf growth.

Major Component:

Nitrogen is a major component of the following which are highly essential for plant life:

- Proteins
- Hormones
- Chlorophyll
- Vitamins
- Enzymes

Excessive Nitrogen:

Too much nitrogen can delay flowering and fruiting.

Deficiency:

Deficiency of nitrogen can:

- Reduce yields
- Cause yellowing of leaves
- Stunt growth

ROLE OF MAGNESIUM

Functions:

- Magnesium is a structural component of Chlorophyll.
- It is necessary for the functioning of plant enzymes to produce carbohydrates, sugars and fats.
- It is used for fruit and nut formation.
- It is essential for the germination of seeds.

Deficiency:

Deficiency of Magnesium causes yellowing and wilting of leaves.

Q. No. 3 Describe importance of fertilizers.

IMPORTANCE OF FERTILIZERS

Fertilizers:

The materials whose addition to soil results in plants with desirable characteristics are celled fertilizers.

Desirable Characteristics:

- More fruit
- Faster growth
- More attractive flowers

Types of Fertilizers:

Fertilizers are broadly classified into two types:

1. Inorganic Fertilizers
2. Organic Fertilizers

Energy content:

One gram of lipids contains 9 kilocalories of energy.

Sources:

Important sources of lipids include:

- Milk
- Butter
- Cheese
- Eggs
- Mutton
- Fish
- Mustard seeds
- Coconut
- Dry fruits

Q. No. 6 Write a note on proteins.

PROTEINS

Composition:

Proteins are composed of amino acids.

Functions:

Many proteins play roles as enzymes. They are essential components of:

- Cytoplasm
- Membranes
- Organelles
- Muscles
- Ligaments
- Tendons

Energy Provision:

They can also be used for gaining energy. They can be converted into carbohydrates.

Energy Content:

One gram of proteins contains 4 kilocalories of energy.

Sources:

Dietary sources of proteins include:

- Meat
- Eggs
- Grains
- Legumes
- Dairy products such as milk and cheese

Q. No. 7 Describe role of different minerals in humans.

MINERALS

Minerals:

Minerals are inorganic elements that originate in the earth and cannot be made in the body.

Functions:

They play roles in various body functions and are necessary to maintain health.

Q. No. 4 Write a note on carbohydrates.

CARBOHYDRATES

Energy Provision:

Carbohydrates are the basic source of energy for all organisms. About half to 2/3 of the total calories every animal consumes daily are from carbohydrates.

Energy Content:

Carbohydrates contain 4 kilocalories per gram.

Examples:

Glucose is the most often used carbohydrate for energy. Other useful carbohydrates are:

- Maltose
- Lactose
- Sucrose
- Starch

Sources:

Humans get carbohydrates from foods like

- Bread
- Pastas
- Beans
- Potatoes
- Bran
- Rice
- Cereals

Q. No. 5 Write a note on lipids.

LIPIDS

Composition:

The lipids present in food are composed of fatty acids and glycerol.

Types of Fatty Acids:

The fatty acids present in lipids are of two types:

1. Saturated fatty acids
2. Unsaturated fatty acids

1. Saturated Fatty Acids:

Saturated fatty acids have all of their carbon atoms bonded to hydrogen atoms. Lipids containing saturated fatty acids are solid at room temperature.

For example: Butter contains 70% saturated and 30% unsaturated fatty acids.

2. Unsaturated Fatty Acids:

Unsaturated fatty acids have some of their carbon atoms double-bonded in place of a hydrogen atom. Lipids containing unsaturated fatty acids are liquid at room temperature.

For example: Sunflower oil contains 75% unsaturated fatty acids.

Functions:

Lipids are used to form:

- Membranes
- Sheaths surrounding neurons
- Certain hormones

Energy Provision:

Lipids are extremely useful energy sources.

Sources:

Humans get calcium from

- Milk
- Cheese
- Egg yolk
- Beans
- Nuts
- Cabbage

Deficiency:

- Deficiency of calcium causes spontaneous discharge of nerve impulses which may result in tetany.
- Bones become soft.
- Blood clots slowly.
- Wounds heal slowly.

ROLE OF IRON

Functions:

- Iron plays a major role in oxygen transport and storage.
- It is a component of haemoglobin in red blood cells.
- It is a component of myoglobin in muscle cells.
- Cellular energy production also requires iron.
- It acts as a co-factor for many enzymes of cellular respiration.
- It also supports immune-function.

Sources:

Humans get iron from:

- Red meat
- Egg yolk
- Whole wheat
- Fish
- Spinach
- Mustard

Deficiency:

Its deficiency is the most common nutrient deficiency worldwide. Iron deficiency causes anaemia.

Q. No. 9 Write a note on vitamin A.

VITAMIN-A

Introduction:

Vitamin A was the first fat-soluble vitamin, identified in 1913.

Functions

- It combines with a protein called opsin to form rhodopsin in rod cells of the retina of eye.
- It is involved in cell-differentiation, a process through which embryonic cells transform into mature cells with specific functions.
- It also supports bone growth and immune functions.

Sources:

Most of the minerals in human diet come directly from:

- Plants
- Water
- Animal foods

Types of Minerals:

Minerals are categorized into:

- **Major Minerals:** The minerals that are required in amounts of 100 mg (milligrams) or more per day are called major minerals.
- **Trace Minerals:** The minerals that are required in amounts less than 100 mg per day are called trace minerals.

IMPORTANT MINERALS IN HUMAN DIET AND THEIR ROLES

<table>
<tr><th>Minerals</th><th colspan="2">Role in body</th></tr>
<tr><td>Major Minerals</td><td colspan="2"></td></tr>
<tr><td>Sodium</td><td>Fluid balance in the body Helps in absorption of other nutrients</td><td rowspan="3">Important for Muscle contraction, Nerve impulse transmission, Heart function and Blood pressure</td></tr>
<tr><td>Potassium</td><td>Fluid balance in the body
Acts as cofactor for enzymes</td></tr>
<tr><td>Chloride</td><td>Fluid balance in the body
Component of hydrochloric acid</td></tr>
<tr><td>Calcium</td><td colspan="2">Development and maintenance of bones and teeth
Blood clotting</td></tr>
<tr><td>Magnesium and phosphorus</td><td colspan="2">Development and maintenance of bones and teeth</td></tr>
<tr><td>Trace Minerals</td><td colspan="2"></td></tr>
<tr><td>Iron</td><td>Oxygen transport and storage</td><td rowspan="2">Act as enzyme cofactors
Support immune function</td></tr>
<tr><td>Zinc</td><td>Aids insulin action, Helps in growth and reproduction</td></tr>
<tr><td>Cooper</td><td colspan="2">Acts as enzyme cofactor</td></tr>
<tr><td>Chromium</td><td colspan="2">Helps in insulin action</td></tr>
<tr><td>Fluoride</td><td colspan="2">Stabilizes bone mineral and hardens tooth enamel</td></tr>
<tr><td>Iodine</td><td colspan="2">Essential for normal thyroid function</td></tr>
</table>

Q. No. 8 Describe role of calcium and iron in humans.

ROLE OF CALCIUM

Functions:

- Calcium is essential for the development and maintenance of bones and teeth.
- It is needed for maintaining cell membranes and connective tissues.
- It is needed for activation of several enzymes.
- It also aids in blood clotting.

Sources:

Vitamin D is mainly found in:

- Fish liver oil
- Milk
- Ghee
- Butter

Synthesis:

It is also synthesized by skin when ultraviolet (UV) radiations from the sun are used to convert a compound into vitamin D.

Deficiency:

Long-term deficiency of vitamin D affects bones.

Rickets: In children, vitamin D deficiency leads to rickets, a condition in which bones weaken and bow under pressure.

Osteomalacia: In adults, vitamin D deficiency causes osteomalacia, or "soft bones," increasing the risk of fractures in bones.

Q. No. 12 Write a note on water.

WATER

Percentage Composition:

Approximately 60% of the adult human body is composed of water.

Functions:

Metabolism:

Nearly all life-sustaining chemical reactions require an aqueous (watery) environment.

Absorption:

Water functions as the environment in which water-soluble food stuff is absorbed in the intestines.

Excretion:

The waste products are eliminated in the urine through water.

Sweating:

An essential role of water is to maintain body temperature through evaporation, as in sweating.

Deficiency:

Severe dehydration may result in cardiovascular problems.

Daily Requirement:

The estimated water requirement of an average adult is two litres per day.

Sources:

Important sources of daily water intake are:

- Natural water
- Milk
- Juicy fruits
- Vegetables

Q. No. 13 Write a note on vitamin dietary fibre

DIETARY FIBRE

Other Name:

Dietary fibre is also known as roughage.

Sources:

Humans get Vitamin A from

- Leafy vegetables (spinach, carrots)
- Yellow/orange fruits (mango)
- Liver
- Fish
- Eggs
- Milk
- Butter

Deficiency:

- Deficiency of vitamin A is the leading cause of blindness in children worldwide.
- One of the symptoms of vitamin A deficiency is night blindness. When vitamin A is inadequate, the lack of rhodopsin makes it difficult to see in dim light. It is a temporary condition, but if left untreated, it can cause permanent blindness.
- Vitamin A deficiency can also cause a condition in which hair follicles become plugged with keratin, giving dry texture to skin.

Q. No. 10 Write a note on vitamin C.

VITAMIN-C

Other Name:

Other name of vitamin C is ascorbic acid.

Significance:

- It is needed to form collagen (a fibrous protein) that gives strength to connective tissues. Collagen is also needed for wound healing.
- Vitamin C in white blood cells enables the immune system to function properly.

Sources:

Humans get Vitamin C from

- Citrus fruits (oranges, lemons, grape-fruit)
- Leafy green vegetables
- Beef liver

Deficiency:

Connective Tissue Changes:

Deficiency of Vitamin C causes connective tissue changes throughout the body.

Scurvy:

The disease known as scurvy results from lack of vitamin C. In this condition the synthesized collagen is unstable. Symptoms of scurvy include:

- Muscle and joint pain
- Swollen and bleeding gums
- Slow wound healing
- Dry skin

Q. No. 11 Write a note on vitamin D.

VITAMIN D

Function: The best-known function of vitamin D is to help regulate blood levels of calcium and phosphorus. Vitamin D increases the absorption of these minerals from intestine and their deposition in bones.

Components of Gastric Juice:

Gastric juice is composed chiefly of:

- Mucus
- Hydrochloric Acid
- Pepsinogen (A protein-digesting enzyme)

Role of HCl

- Hydrochloric acid converts the inactive enzyme pepsinogen into its active form i.e. pepsin.
- HCl also kills microorganisms present in food.
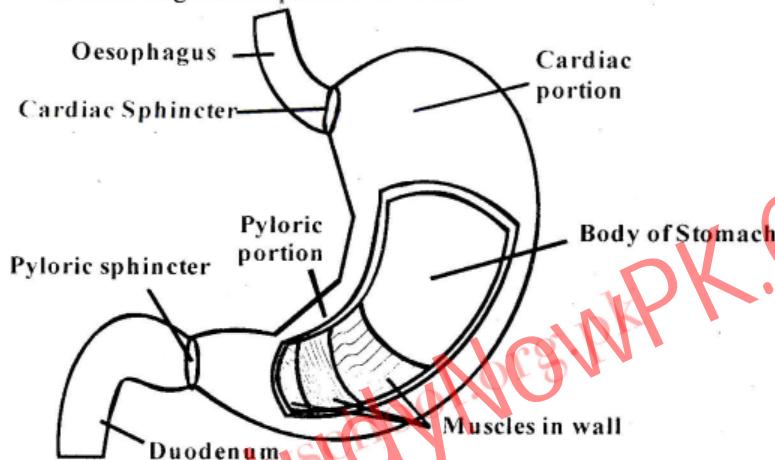
Figure: Structure of Stomach

Role of Pepsin:

Pepsin partially digests the protein portion of food into polypeptides and shorter peptide chains.

Role of Mucus:

Mucus not only aids in lubrication, but it forms a thick coating over the inner walls of stomach, and protects them from the strong HCl by neutralizing it. Hence pepsinogen cannot be activated to attack stomach walls.

ii. Churning and Melting:

Churning is a process by which food is further broken down in the stomach. The walls of stomach contract and relax and these movements help in thorough mixing of gastric juice and food. The churning action also produces heat which helps to melt the lipid content of food.

Chyme Formation:

The starch and protein in the food have been partially digested and the food has been converted into a soup-like mixture called chyme. After it, the pyloric sphincter allows a little mass of chyme to enter duodenum.

Role of Gastrin:

The peptides stimulate some cells of stomach walls to release a hormone celled gastrin. This hormone enters blood and is distributed to all parts of body. In stomach, it has specific effect and stimulates the gastric glands to secrete more gastric juice.

Q. No. 21 Describe the role of small intestine in digestion.

SMALL INTESTINE

The stomach opens into the small intestine.

Parts:

Small intestine has three parts:

i. Duodenum
ii. Jejunum
iii. Ileum

i. Duodenum:

It is the part of small intestine where most of the digestive process occurs.

Length

Duodenum comprises the first 10 inches (25 cm) of small intestine.

Functions:

In small intestine, food is further mixed with 3 different secretions:

- **Bile:** Bile from liver helps in the digestion of lipids through the process of emulsification i.e. by keeping the lipid droplets separate from one another.
- **Pancreatic Juice:** Pancreatic juice from pancreas contains three enzymes:
  Trypsin digests proteins.
  Pancreatic amylase digests carbohydrates.
  Lipase digests lipids.
- **Intestinal Juice:** Intestinal juice from intestine walls contains many enzymes for the complete digestion of all kinds of food.

ii. Jejunum:

Next to the duodenum is jejunum.

Length:

It is 2.4 meters long.

Functions:

It is concerned with the rest of the digestion of proteins, carbohydrates and lipids.

iii. Ileum:

This is the last part of the small intestine.

Length:

It is 3.5 meters long.

Function:

It is concerned with the absorption of digested food.

ROLE OF SMALL INTESTINE IN ABSORPTION

Villi:

There are circular folds in the inner wall of ileum. These folds have numerous finger like projections called villi. The singular of villi is villus.

Structure of a Villus:

- Each villus is richly supplied with blood capillaries.
- It has a vessel of lymphatic system called lacteal.
- The walls of a villus are only single cell thick.

Function:

- Villi increase the surface area of the inner walls.
- They help in the absorption of food.

Absorption of Sugars and Amino Acids:

The digested molecules i.e. simple sugars and amino acids are absorbed from intestine into the blood capillaries present in villi. The blood carries them away from the small intestine via the hepatic portal vein and goes to liver for filtering. Here the toxins are removed and extra food is stored.

Absorption of Fatty Acids and Glycerol:

Fatty acids and glycerol are absorbed into the lacteal of villus. The lacteal carries them to the main lymphatic duct, from where they enter in bloodstream.
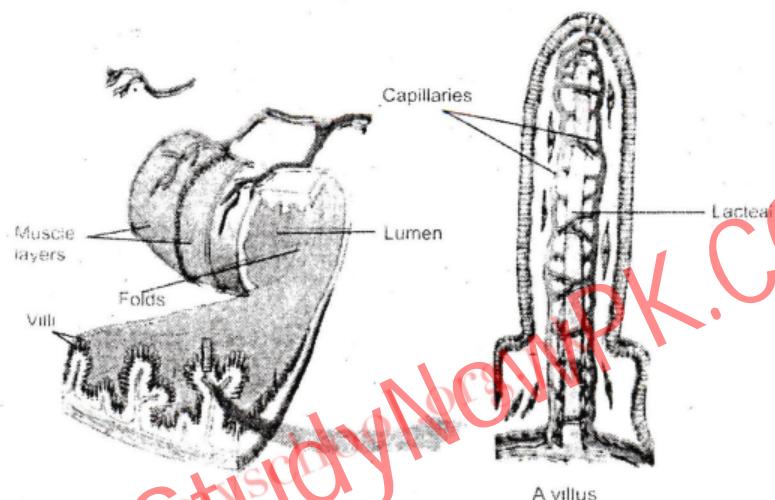
Figure: Folds and Villi in Small Intestine

Q. No. 22 Describe the role of large intestine in human digestive system.

LARGE INTESTINE

After the absorption of digested food in the blood, the remaining mass enters the large intestine.

Parts:

Large intestine has three parts:

i. Caecum (the pouch that forms T-junction with small intestine).
ii. Colon
iii. Rectum

Functions:

Large intestine performs the following main functions:

- Absorption of water
- Defecation

Absorption of water:

From colon, water is absorbed into blood.

Faeces:

After the absorption of water, the solid remains of food are called faeces.

Components of Faeces:

Faeces mainly consist of:

- Undigested material
- A large number of bacteria

- Dead cells of alimentary canal
- Bile pigments
- Water

Storage of Faeces:

Faeces are temporarily stored in the rectum, which opens out through anus.

Defecation:

The expulsion of faeces through anus is called defecation.

Mechanism:

When the rectum is filled up with faeces, it gives rise to a reflex and anus is opened for defecation.

Control of Reflux:

In Adults:

The reflux is consciously inhibited in adults.

In Infants:

In infants, it is controlled involuntarily. During growth, child learns to bring this reflex under voluntary control.

Q. No. 23 Write a note on liver.

LIVER

Largest Gland:

Liver is the largest gland of the body.

Color:

It is a dark-reddish in appearance.

Weight:

It weighs about 1.5 kg.

Size:

It is the size of a football.

Location:

It lies beneath the diaphragm, on the right side of abdomen.

Lobes:

It is multi-lobed.

GALL-BLADDER

Shape:

It is pear-shaped.

Color:

It is a greenish-yellow sac.

Location:

It lies along the right lobe of liver on ventral side.

BILE JUICE

The secretion of the liver is called bile juice.

Storage: Bile is stored in gall-bladder.

Release: When gallbladder contracts, bile is released into duodenum through common bile duct.

Composition: Bile has no enzymes but contains bile salts for the emulsification of lipids.

Function: It helps the lipid-digesting enzymes to attack on lipids
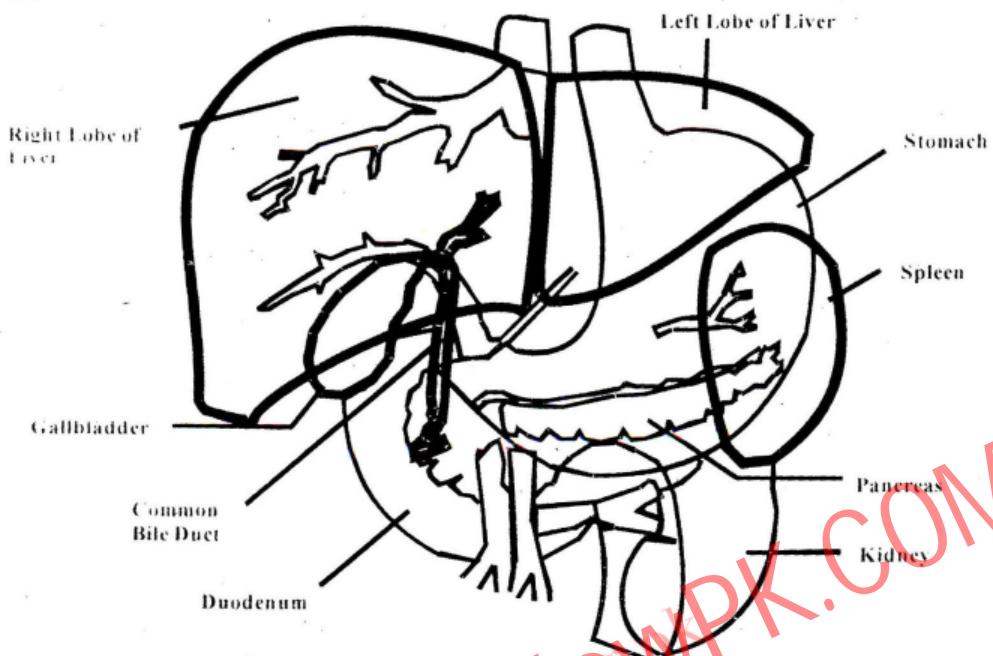
Figure: Liver and Associated Organs

FUNCTIONS OF LIVER

Besides digestion, liver carries out a number of other functions, some of which are summarized here:

De-amination:

It removes amino-groups from amino-acids.

Formation of Urea:

It converts ammonia to a less toxic form, urea.

Destruction of Red blood cells:

It destroys the old red blood cells.

Formation of Fibrinogen:

It manufactures blood clotting protein called fibrinogen.

Glucose-Glycogen Interconversion:

It converts glucose into glycogen and, when required, breaks glycogen into glucose.

Cholesterol Formation:

It converts carbohydrates and proteins into lipids and produces cholesterol.

Heat Production:

It produces heat to maintain body temperature.

Storage of Vitamins and Ions:

It stores fat-soluble vitamins (A, D, E, and K) and mineral ions, such as iron.

Q. No. 24 **Write the names of organs of our digestive system and draw a labeled diagram.**

HUMAN DIGESTIVE SYSTEM

The digestive system of human consists of a long tube that extends from mouth to anus. This tube is called alimentary canal.

The human digestive system consists of the following organs:

Main Organs:

- Oral cavity
- Pharynx
- Oesophagus
- Stomach
- Small intestine
- Large intestine
- Rectum
- Anus

Glands:

- Three pairs of salivary glands
- Pancreas
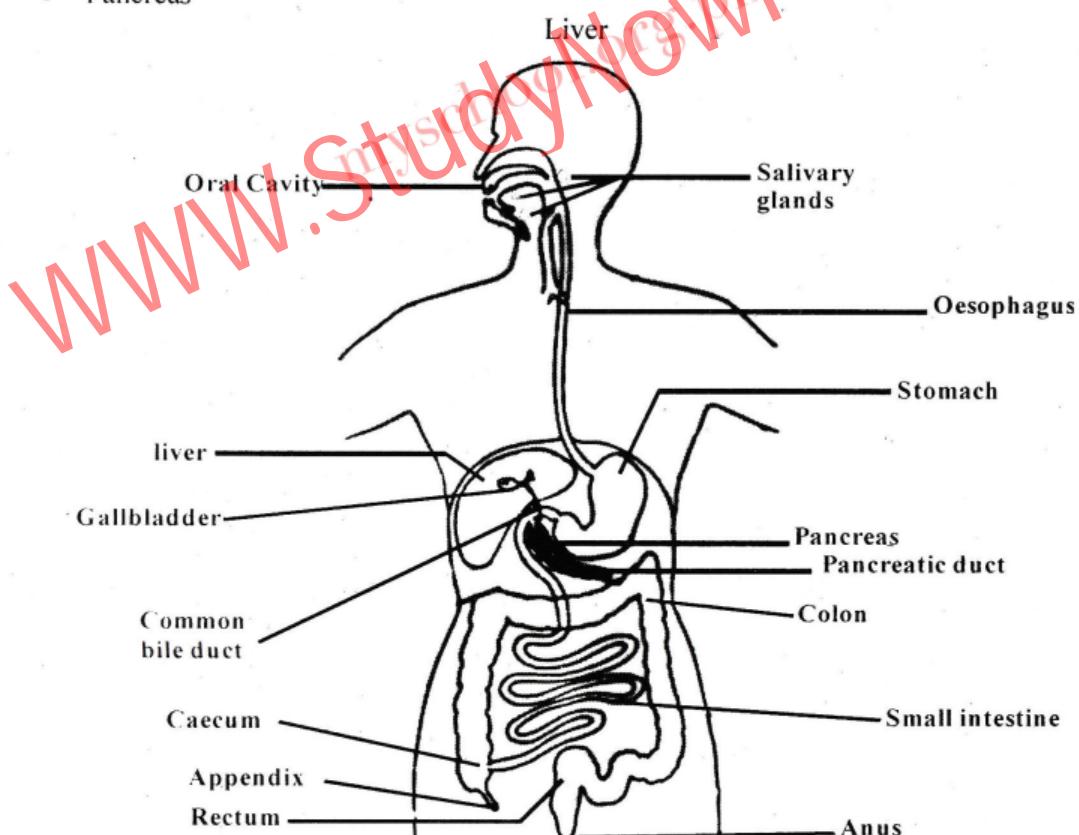
Figure: Human Digestive System

Q. No. 25 Describe disorders of the gut.

DISORDERS OF GUT

The most common disorders of the gut that affect a number of people in Pakistan are:

1. Diarrhoea
2. Constipation
3. Ulcer

1. DIARRHOEA

Introduction:

It is a condition in which the sufferer has frequent watery, loose bowel movements.

Symptoms:

- Loose, watery stools
- Abdominal pain
- Nausea
- Vomiting

Causes:

- When required water is not absorbed in blood from colon.
- Lack of adequate safe water.
- Viral or bacterial infections of large intestine.

Recovery:

If sufficient food and water is available, the patient of diarrhea recovers in a few days. However, for malnourished individuals, diarrhoea can lead to severe dehydration and can become life-threatening.

Treatment:

- Consuming adequate amounts of water (to replace the loss)
- Intake of essential salts and nutrients with water
- Antibiotics in cases of bacterial infection.

Prevention:

Diarrhoea can be prevented by:

- Taking clean water
- Intake of essential salts
- Eating regularly
- Taking hygienic measures

2. CONSTIPATION

Introduction:

Constipation is a condition where a person experiences hard faeces that are difficult to eliminate.

Causes:

The main causes of constipation include:

- Excessive absorption of water through colon
- Insufficient intake of dietary fiber
- Dehydration
- Use of medicines (e.g. those containing iron, calcium, aluminium)
- Tumors in rectum or anus

Prevention:

Constipation is usually easier to prevent than to treat. One should take the required quantities of water and dietary fibres.

Treatment:

The treatment of constipation includes:

- Changes in dietary and exercise habits
- Use of laxatives (e.g. Paraffin)
- Intake of sufficient water
- Intake of dietary fiber

3. ULCER

Introduction:

An ulcer (peptic ulcer) is a sore in the inner wall of gut, i.e., in:

- Oesophagus
- Stomach
- Duodenum

Pathology

In ulcer, the acidic gastric juice gradually breaks down the tissue of the inner mucosal wall.

Causes:

The causes of ulcer include:

- Excess acid
- Infection
- Long term use of anti-inflammatory medicines (including aspirin)
- Smoking
- Drinking coffee
- Drinking colas
- Eating spicy foods

Signs and Symptoms:

The signs and symptoms of ulcer include:

- Abdominal burning after meals or at midnight
- Severe ulcers may cause abdominal pain
- Rush of saliva after an episode of regurgitation
- Nausea
- Loss of appetite
- Weight loss

Treatment:

Ulcer is treated with medicines which neutralize the acidic effects of gastric juice.

Preventive Measures:

The following things should be avoided as preventive measures:

- Spicy foods
- Acidic foods
- Smoking

REVIEW QUESTIONS

MULTIPLE CHOICE

1. **What are the primary nutrients that provide quick useable energy to body?**
(a) Carbohydrates (b) Proteins (c) Lipids (d) Nucleic acids
2. **The wavelike movement of muscle that pushes food through digestive system is called:**
(a) Churning (b) Emulsification (c) Absorption (d) Peristalsis
3. **Micronutrients of plants are:**
(a) Available in the soil in only small amounts (b) Required by plants in small amounts
(c) Small molecules required by plants (d) Useful, but not required by plants
4. **Which of the following does not occur in the oral cavity?**
(a) Lubrication of food (b) Beginning of protein digestion
(c) Breaking the food into small fragments (d) All of the above do occur in the oral cavity
5. **Where are villi found?**
(a) Esophagus (b) Stomach (c) Small intestine (d) Large intestine
6. **Ulcers occur in:**
(a) Stomach (b) Duodenum (c) Esophagus (d) All of these
7. **Which group of enzymes breaks up starches and other carbohydrates?**
(a) Proteases (b) Lipases (c) Amylases (d) None of these
8. **Pancreas produces digestive enzymes and releases them into:**
(a) Colon (b) Gall bladder (c) Liver (d) Duodenum
9. **In stomach, pepsinogen is converted into:**
(a) Pepsin (b) Bicarbonate (c) HCl (d) Gastrin
10. **Hepatic portal vein carries blood from ____ to _______.**
(a) Small intestine, liver (b) Small intestine, heart
(c) Liver, heart (d) Small intestine, colon
11. **Which of the following is not a function of liver?**
(a) Converts glucose to glycogen (b) Converts glycogen to glucose
(c) Manufactures fibrinogen (d) Produces digestive enzymes
12. **The diseases of Kwashiorkor and Marasmus may be due to:**
(a) Mineral deficiency (b) Over-intake of nutrients
(c) Protein-energy malnutrition (d) Ulcer
13. **Which food group is our body's best source of energy?**
(a) Meat group (b) Fats, oils, and sweets (c) Breads and cereals (d) Milk and cheese
14. **What may be the reason that children need more calcium and iron?**
(a) Both calcium and iron for bones (b) Both calcium and iron for blood
(c) Calcium for blood and iron for bones (d) Calcium for bones and iron for blood
15. **The process of breaking down large droplets of fat into small droplets is called:**
(a) Emulsification (b) Absorption (c) Peristalsis (d) Digestion

ANSWERS:

1	a	2	d	3	b	4	b	5	c
6	d	7	c	8	d	9	a	10	a
11	d	12	c	13	c	14	d	15	a

UNDERSTANDING THE CONCEPTS

(1) What are the effects of lack of nitrate and magnesium ions on plant growth?

Consult Long Question No. 2

(2) How are inorganic and organic fertilizers important in agriculture?

Consult Long Question No. 3

(3) Draw a table that can show sources, energy values, and functions of carbohydrates, proteins, and fats.

COMPARISION OF CARBOHYDRATES, PROTEINS AND FATS

Nutrient	Sources	Energy values	Functions
Carbohydrates	Bread, pasta, beans, potatoes, bran, rice, cereals	4 kilocalories/gram	Basic and quickly usable source of energy
Proteins	Meat, eggs, grains, legumes, dairy products like milk & cheese	4 kilocalories/gram	Essential components of: • Cytoplasm • Membranes • Organelles Major components of: • Muscles • Ligaments • Tendons Play roles as Enzymes Play role in Growth Energy source
Fats	Milk, butter, cheese, eggs, mutton, fish, mustard seeds, coconut, dry fruits etc	9 kilocalories/gram	Used to form: • Membranes • Sheaths around neurons • Certain hormones Energy source

(4) How are vitamins A, C and D important in our diets?

Consult Long Questions No. 9, 10 & 11

(5) Which foods contain calcium and iron and what roles do these minerals play in our bodies?

Consult Long Question No. 8

(6) Why are water and dietary fibres considered important in our diets?

Consult Long Questions No. 12 & 13

(7) Define balanced diet. How would you relate it with age, gender and activity?

Consult Long Question No. 14

(8) Describe how protein energy malnutrition, mineral deficiency diseases and over intake of nutrients are the major forms of malnutrition.

Consult Long Question No. 15

(4) Which sphincters play role in the movement of food in and out of stomach?

SPHINCTERS

Sphincters are the openings which are guarded by muscles.

Stomach has two sphincters:

- **Cardiac Sphincter** is between stomach and oesphagus. Bolus enters stomach through esophagus through this sphincter.
- **Pyloric Sphincter** is between stomach and small intestine.

(5) Stomach is an organ of the digestive system, but it also secretes a hormone. What hormone is it and what function it performs?

HORMONE SECRETED BY STOMACH

The hormone secreted by stomach walls is gastrin. The presence of proteins in our food causes secretion of abundant amounts of gastric juice which digests these proteins into peptides. These peptides stimulate some cells of stomach walls to gastrin.

Effects of Gastrin:

This hormone enters blood and is distributed to all parts of body. In stomach it has a specific effect and stimulates the gastric glands to secrete more gastric juice.

THE TERMS TO KNOW

Amylase: An enzyme which digests starches and other carbohydrates
Anemia: A condition caused by deficiency of iron in diet, resulting in low haemoglobin levels
Appendix: A non-functional projection arising from blind end of caecum
Assimilation: Conversion of absorbed simple food into the complex substances constituting body.
Balanced diet: A balanced diet is defined as one which contains all the essential nutrients in correct proportion for the normal growth and development of body.
Bolus: A small, slippery mass of chewed food rolled up in oral cavity
Cardiac sphincter: One of the two sphincters of stomach, located between stomach and esophagus
Chime: A soupy blend of partially digested food and digestive juices, formed in the stomach
Colon: *The middle part of large intestine, harbors beneficial bacteria and absorbs water and salts*
Constipation: *A condition in which faeces are hard and difficult to eliminate*
Diarrhea: *A condition in which frequent watery stools are passed*
Dietary fiber: Roughage, or the indigestible part of food, commonly found in plant foods only
Digestion: The process of breaking up larger food molecules into simpler ones
Duodenum: The first part of small intestine, where liver, pancreas, and intestine itself, exert their digestive actions
Emulsification: The process of keeping lipid droplets separate from one another.
Epiglottis: A thin, leaf like cartilaginous structure which folds back over the opening of the windpipe during swallowing to prevent the entry of food into it.
Famine: Lack of enough food to feed all the people in an area
Fat-soluble vitamins: Vitamins A, D, E, and K, which are usually stored in liver and fatty tissues. They do not need to be replaced daily
Fertilizer: Certain materials which when added to soil sometimes resulted in plants with desirable characteristics. (e.g. more fruit, faster growth, more attractive flowers).
Gastric juice: A digestive secretion of stomach, consisting of Pepsin, HCl, mucus, and gastrin
Gastrin: A hormone produced by stomach walls, as a feedback of proteinous food

Goiter: A condition caused by deficiency of Iodine in diet, causing enlargement of thyroid gland
Ileum: The last part of small intestine, concerned with absorption / assimilation of digested food
Intestinal juice: The digestive secretion of small intestine, slightly alkaline in nature.
Jejunum: The middle part of small intestine concerned with complete digestion of food
Kwashiorkor: A disease caused by protein-deficiency when breastfeeding is discontinued, resulting in abnormal development of children
Lacteal: A vessel of lymphatic system which absorbs dietary fats from small intestine
Laxatives: Drugs which relieve constipation
Lipase: An enzyme which breaks down fats into fatty acids and glycerol
Liver: A large, reddish brown lobed organ, involved in many digestive and metabolic functions of body
Malnutrition: A condition caused by deficient or improper diet
Marasmus: A condition caused by protein-energy malnutrition, resulting in poor growth and skeletal appearance of children
Mineral deficiency diseases: Diseases caused by the deficiency of a mineral in diet, such as anemia
Nutrition: The process in which food is obtained or prepared, absorbed, and converted into body substances for growth and energy.
Oesophagus: A muscular tube, also called as food-pipe, which connects pharynx to the stomach
Oral cavity: The space behind mouth, bound by lips, cheeks, palate, and containing tongue and teeth.
Over-intake of nutrients: A form of malnutrition caused by intake of more nutrients are taken than the amounts required for normal growth, development and metabolism
Pancreas: A small tongue-shaped gland located below stomach, which secrets digestive enzymes into the lumen of duodenum
Pancreatic juice: A digestive secretion of pancreas, containing enzymes for the digestion of carbohydrates, proteins, and lipids.
Pepsin: A protein-digesting enzyme produced in stomach, which causes partial digestion of proteins into peptide chains.
Pepsinogen: Inactive form of the enzyme Pepsinogen, produced by chief cells of stomach, and is converted into its active form Pepsin by HCl present in gastric juice.
Peristalsis: Wave-like rhythmic movement of alimentary canal used to propel food down along the digestive tract.
Protein-energy malnutrition: The inadequate availability or absorption of energy and proteins in blood
Pyloric sphincter: One of the two sphincters of stomach, located between stomach and small intestine
Rectum: The last part of the small intestine, concerned with the storage of faeces
Saliva: Alkaline secretion produced by salivary glands in mouth, containing water, mucus and enzymes
Starvation: A condition of severe reduction in nutrient and energy intake, caused by malnutrition
Stomach: A muscular, dilated part of alimentary canal concerned with the storage and partial digestion of food
Swallowing: The process by which food is transferred from the oral cavity to the esophagus
Trace minerals: Essential minerals required in very small amounts (less than 100 mg per day)
Trypsin: A protein-digesting enzyme produced by pancreas
Ulcer: A sore, or erosion, on the skin or mucus membrane
Villus: One of the towel-like projections in the Ileum of small intestine, which increase the surface area and absorb digested food
Vitamins: Essential organic compounds required in small amounts but cannot be synthesized in body.
Water-soluble vitamins: Vitamins B and C, which are soluble in water. They are not stored in body and must be replaced everyday.